Journal of the Society of Arts.

FRIDAY, MARCH 29, 1867.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at Eight o'Clock:—

APRIL 3.—The following subject for discussion will be introduced by THOS. HAWKSLEY, Esq., M.D. Lond.:—"How to provide Healthy and Cheap Dwellings for the Working Classes with Financial Success."

CANTOR LECTURES.

A Course of Lectures "On Music and Musical Instruments," by JOHN HULLAH, Esq., is now being delivered as follows:—

LECTURE V.—MONDAY, APRIL 1.

MUSICAL INSTRUMENTS.—Classification—Wind Instruments—Stringed Instruments—The Plectrum, Hammer, and Bow—Instruments of the Ancients—Mediæval Instruments; their Introduction into the Church.

LECTURE VI.—MONDAY, APRIL 8.

MUSICAL INSTRUMENTS (*continued*).—Modern Instruments—Chamber and Orchestral—Combination—The Modern Orchestra—Conclusion.

The lectures commence each evening at eight o'clock, and are open to members, each of whom has the privilege of introducing one friend to each lecture.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

FOOD COMMITTEE.

The Sub-Committee on Meat met on Friday, the 15th instant. Present—Mr. Harry Chester, in the Chair; Messrs. C. S. Read, M.P., C. Wren Hoskyns, F. Parish, E. Wilson, J. Ware, and J. Ludford White.

Mr. TINDAL, of Clarence River, New South Wales, attended, and in reply to questions from the Chairman and other members of the committee, stated that he was one of a private company of twelve, who had embarked capital in a meat-preserving establishment at the Clarence river, where he resides. The Company kill a large number of cattle annually, and are now sending over the meat preserved in a cooked state in tins, after the well-known process which has been so long in use. Consignments are made to Messrs. M'Call and Co., in this country. The Company had already sent two consignments of about 60,000lbs. and had made arrangements for sending that amount monthly. This is sold in six pound tins, at 7d. per lb. retail for the best parts, and 6d½. per lb. for the inferior parts. It has hitherto been sold principally for shipping purposes. The cattle are in the best condition for killing in the months of April and May. They can kill 10,000 head annually. Mr. Tindal considers that an Australian bullock furnishes more and better meat than a South American bullock. Only the meat is preserved, and the bones are dealt with in other ways. The shank bones are worth from £10 to £15 a ton, and are sent to England; the other bones are ground and used for manure. The ground bones would not pay to send to England, the freight is too high. In reply to questions in reference to this sending of meat to England, Mr. Tindal stated that the process was equally applicable for mutton, but that it would not pay so well commercially to send over mutton. In the first place, the mutton was dearer than beef—the wethers are kept longer before coming to maturity than bullocks—the former being kept seven years, whilst the latter is fit to be killed in four years. Again, as the bones have to be taken out, there is as much labour in taking out the bone of a sheep as of an ox, or nearly so, and the proportionate amount of meat is much larger in the one case than the other. It therefore does not pay so well to send mutton as beef. The cattle in Australia are originally of English breed, and by the purchase of English prize bulls the breed has been brought to a high degree of perfection. Mr. Tindal's company make and export the *Extractum carnis*. The sale is greatly increasing. The company has in their pay a scientific chemist, under whose superintendence the company's business is conducted. The *Extractum carnis* cannot be made profitably from veal, or, indeed, from any young meat; veal meat is very deficient in the materials which form the *Extractum carnis*.

Mr. MCCALL, of the firm McCall and Co., Houndsditch, provision merchants, stated, in reply to questions from the committee, that the trade in Australian preserved beef was quite new, and at present the sale was confined to the shipping trade; indeed the article was unknown in the home trade, but it was his intention to place it before the public generally through the ordinary retail channels, and, until this was carried out, his firm were willing to supply a single tin at the above-named prices. Some persons objected to the meat being cooked, and they were now experimenting with a view of bringing in preserved uncooked meat; but, although these experiments were promising, they had not hitherto succeeded in obtaining such a measure of public support as would enable them to embark in that enterprise. With regard to turtle, he stated that the turtle were killed in Jamaica; the calipash and calipee, or lining of the shell, is dried, packed in tin-lined boxes and sent over to this country. The turtle flesh is not sent over. This dried calipash and calipee, when required for use, is soaked for several days, and made into soup with veal stock. The main supply of turtle soup is thus made. Live turtle, no doubt, are sent over here, but a very large number of them are only fit to be killed immediately on their landing, and their calipash and calipee is dried for preservation until wanted for use. Messrs. McCall preserve large quantities of English meat in the same way as that in which the Australian meat is preserved. The bones form 25 per cent. of the carcase; thus a 6lb. tin of meat represents 8lbs. of butchers' meat. He further stated that the heavy beef preserved in this manner at the Deptford Victualling yard must cost the government 11½d. per lb. He could offer Mr. Tindal's Australian beef at 7d. per lb., with a discount of course on the sale of a large quantity.

Lord De L'Isle laid before the Sub-committee on Milk, at one of their Meetings, the following remarks on—

THE SYSTEM OF COW-KEEPING AS PRACTISED IN THE NORTH OF ENGLAND, AS REGARDS THE SUPPLY OF MILK TO THE LABOURING CLASSES. By Mr. STURGESS.

The system of cow-keeping practised by a portion of the agricultural labouring class living in the agricultural villages in the north of England is of old growth, and has now become, to a certain extent, an institution of the district. There can be no doubt in the minds of those who have seen it in operation, that it has tended to the improvement of the position of the industrious and painstaking labourer, enhanced in a material degree his home comforts, given him an interest in the locality, and bound him with a tie of no ordinary character to the occupation he holds; further, it has been the means of retaining in districts many steady, good workmen, who have been of essential service to the farmer located with him in the same parish. This system of cow-keeping, I think, may be considered an elder member of the garden allotment system, for the aim of the latter was, no doubt, to advance further, but in another form, the principle of getting the labourer to settle down, by attaching to his cottage a small plot of garden ground, wherein he could occupy the leisure-hours of himself and children, and thus add to his means for procuring more comforts for his family. Before giving particulars of the system, it would be well first to mention that it necessarily involves some additional expenses to be incurred by the owner, in providing the needful accommodation for cow-keeping, and sub-dividing the land with quick fences or post and rails into small and convenient-shaped holdings; and although this expense at first sight may appear heavy, yet I do not doubt that, with the increased rent generally obtained for the cottage and land over what is paid by the neighbouring tenant-farmer for similar land, the cottager pays interest, in the shape of rent, for the additional accommodation that has to be provided for him under this system. The additional accommodation may be stated simply to consist of a small additional space being required in the cottage for a dairy, say about 8 feet long by about 6 feet wide. The cow-house should be about 12 feet long and 8 feet wide; this would give room for one cow and a calf, or, if the latter was not kept, two cows might be accommodated. The pig-stye cannot be called an addition, it being generally attached to all cottages in agricultural villages. The extra cost, therefore, for dairy-room in house, with cowhouse, would not be more, I estimate, than from £20 to £25, in fact, in many places, the accommodation required is put up at a very trifling expense.

I now beg to add the following particulars in regard to the extent of land occupied with cottages under this system, the amounts of rent paid, with a description of the class of labourer holding those tenancies in the north, and which, I must observe, more particularly refers to the North Riding of Yorkshire:—

Description of Labourer.	Land occupied. A.	R.	P.	Rent paid for Land and Cottage. £	s.	d.
1. Worked in a brewery....	1	0	36	10	10	0
2. General farm labourer ..	5	2	15	16	15	0
3. Ditto ditto ..	2	1	22	15	10	0
4. Bricklayer	3	3	13	14	2	0
5. General farm labourer ..	1	1	14	6	12	0
6. Ditto ditto ..	1	3	22	10	6	0

The houses attached to the above occupations are good, and where the land held exceeded two acres, the tenants had increased accommodation for additional stock keeping. I may also add that, in connection with the above tenancies, the tenants had the opportunity of "gating" out his cow during summer in a gentleman's park adjoining the village, thus giving him an opportunity of cutting his own grass for hay. The cost, I may note, for pasturing a cow from May-day to Michaelmas (20 weeks) varies from 60s. to 80s., according to size of animal.

Particulars of certain Occupations continued, but taken from another part of Riding.

Description of Labourer.	Land occupied. A.	R.	P.	Rent paid for Land and Cottage. £	s.	d.
1. General farm labourer ..	10	1	21	13	10	0
2. Worked on the public roads.....	5	0	2	10	19	0
3. Gentleman's servant....	5	0	27	12	10	0
4. Village blacksmith	4	2	34	14	14	0
5. „ carpenter	6	1	33	21	0	0
6. General farm labourer ..				8	5	0
7. Ditto ditto ..	8	2	19 pasture	8	5	0
8. Ditto ditto ..	5	2	0 meadow	8	5	0
9. Ditto ditto ..				8	5	0

The four last occupations had a pasture field allotted among them, containing 8a. 2r. 19p., so they all grazed an equal number of cows in it. The meadow field, 5a. 2r. 0p., was divided by stakes into four portions, so that each knew his own meadow piece for cutting. The first five occupations in the above list had sufficient ground for keeping two or more cows both winter and summer.

Particulars continued, but taken from a different part of the Riding.

Description of Labourer.	Land occupied. A.	R.	P.	Rent paid for Land and Cottage. £	s.	d.
1. Village carpenter	4	0	39	12	0	0
2. General farm labourer ..	1	2	22	6	0	6
3. Ditto ditto ..	6	2	18	9	12	0
4. Ditto ditto ..	4	3	34	8	0	0
5. Ditto ditto ..	4	2	0	8	0	0
6. Village schoolmaster	3	3	3	7	10	0
7. „ smith	5	0	28	13	14	0
8. General farm labourer ..	3	0	22	9	10	0
9. Village shoemaker	5	0	9	10	0	0

In some of those last-named occupations, where the quantity of land was not sufficient for pasturing a cow during summer, and reserving a portion to cut for hay, the cottager either got a grant to run his cow in the lanes, or, if that was not obtained, he generally got pasturage with a neighbouring tenant-farmer.

In reference to the disposal of the produce of the cow, it may be stated that, as a general rule, it is made into butter, for which in the district there is a steady and regular demand, arising principally from the increase of large manufacturing towns in the Riding. It is, however, not to be understood that no milk from the cow is sold; on the contrary, where any labourer in a village is without a cow he can have a good supply at 1d. per pint. Under those circumstances there is no lack to those desirous of obtaining it. Of the skim milk which is left after the cream is taken off, part is used by the family, and part is sold, the remainder going to help the feeding of one or two pigs.

From a personal knowledge of the system, extending over more than 20 years, I can speak to its beneficial effect in promoting industry, giving greater comfort and many additional luxuries to the labouring man's family, and also as having been the means of promoting socially his own and children's advancement. In many instances I have known that it has helped the labouring man to place one or two of his sons in a useful trade; and as regards the female portion, it has helped, by the duties incident to their position while at home, to prepare them for making useful servants to the farmers and others resident in the district. In respect to any difficulty in obtaining tenants for those small occupations, I can only add, that on a vacancy occurring it is eagerly inquired after, and soon a choice of tenants offers; further, as to punctual discharge half-yearly of the rents, it is satisfactory to state that an arrear rarely, if ever, occurs; I have never known one.

The success which, as shown by the foregoing remarks, attends the cow-keeping system, has only

been attained by the length of time it has been in operation, as it must be evident to every one who has made inquiry into its working, that a great deal depends upon the management and skill which the labourer's wife can bring to bear to the occupation, it being left principally in her hands to manage; otherwise without that skill it could not be expected to succeed. It may also be noticed that the system under consideration is now so far recognised as to the advantages which it has conferred, that there is a regular prize now offered by the local agricultural associations for the best cottager's cow; and in this class at those local gatherings cows of excellent quality are exhibited. The cow clubs are also numerous among them, where, by a small annual payment, the loss of a cow is provided against.

In making a few concluding remarks as to how this cow-keeping system could be applied to the south, I may note, first, as regards the land, that I think the grass lands of the north are better, as well as the herbage; they are also, in the neighbourhood of the villages, divided into small fields, suitable for this class of occupation. I have not found this so in some of the districts south of London. This, however, in itself, need not be a fatal objection to a trial of the system, if other circumstances were favourable. Of course, in the chalky districts, where the grass lands are very poor, the system could not be introduced with any fair prospect of success, for owing to the quantity of artificial food which would have to be purchased to assist to keep a cow in condition on this description of land, the expense of this artificial food would deprive the system of the advantages it is presumed to confer.

Taking, however, the other districts of the south, where the grass land is of fair quality, and where facilities would be given for dividing a few grass fields into suitable occupations for the keep of a cow, there is the practical difficulty yet to be got over, that neither the labourer nor his wife, especially the latter, is qualified by previous experience to undertake the management of cows; further, it is not a system that can be taken up at once, although funds may not be wanting for providing the cows, &c. It is upon the experience of the housewife that so much depends to make the occupation of advantage, aided no doubt by the co-operation and assistance which she receives from her children, who are early instructed in those duties. In my experience of the south, I should say that it is next to impossible to find a female, wife or servant, that can milk, let alone knowing anything about butter-making and other duties attending the successful working of the system. Further, it is far from general that the labouring man knows anything about cows, or is able to milk one, and, therefore, however well the system may be shown to answer in the north, it would not follow, from the circumstances before noted, that if tried it might be equally successful in the south.

The economy of living and the food consumed by the labouring class in the south are very different to the custom in this respect in the north; in the latter more animal food being taken and more milk used, whereas in the former meat does not enter into consumption except to a limited extent, and, in the place of milk, beer or cider is the substitute. The use of the two latter as a part of the domestic economy of the labouring man's household, is, I am afraid, a great inducement to his visiting and being found often at the beer house.

If the system could by any means be introduced, there is no doubt that much good might be derived from it, not only in elevating the position and character of the labouring class, adding greatly to his home comforts, but also further (which I should myself put some stress upon), in the duties which would necessarily be thrown upon the family; these would tend to qualify them for making good and creditable servants, who would thus be more conversant with the duties required of them in many situations they might be called upon to take.

These few suggestions have occurred to me in the consideration of this subject; no doubt more detail could be entered into if space was available, but I trust the little I have adduced in reference to this matter may be of service in helping to bring into notice a branch of cottage economy which I believe has been and is now doing good service in the north of England.

In reference to the foregoing memorandum, Lord De L'Isle writes:—

The above able and comprehensive remarks of Mr Sturgess, so thoroughly explain the subject, that comment on my part is almost unnecessary.

I would simply observe that the system of cow-keeping in the north of England is one of long standing, the growth of years, and it has tended much to the comfort of the labouring class. Whether such a system could be established, in suitable districts in the south, with fair prospect of success, is a question which requires some consideration.

The principle of allotments has answered well in certain places, in others it has not met with the same amount of success.

The habits of the labourers in the north differ much from those of the south, and in the management of a dairy much depends on the skill, cleanliness, and industry of the wife.

In the north most of the labouring-classes are well acquainted with the management of dairy-stock, but this is not the case in most parts of the south of England, where great difficulty exists in finding either a man or a woman who can even milk properly.

These are some of the difficulties which would attend the introduction of this system; but I cannot help thinking that, from the success it meets with in the north, it is well worthy the attention of landlords, as a means of giving to the labourer a more permanent interest in the soil, and by his own industry and good management adding many comforts to his home. It would also enable him to sell milk in small quantities to those of his own class who now frequently experience great difficulty in obtaining even a limited supply.

CANTOR LECTURES.

"ON MUSIC AND MUSICAL INSTRUMENTS." BY JOHN HULLAH, ESQ.

LECTURE IV.—MONDAY, MARCH 25.

MUSICAL NOTATION.

Having described the four properties of musical sound—duration, pitch, intensity, and timbre—Mr. Hullah said that the first two of these were incomparably the most important. Duration and pitch (time and tune) are not so much essentials of music as music itself. Without time musical sounds want form; without tune they want life. An efficient musical alphabet must be competent to represent, or convey accurately, duration and pitch. In this respect the alphabet of music will differ from all others; since, with a few partial exceptions, no other attempts to represent anything but sound, and that in a very unprecise manner. Two systems of musical notation have long existed—the one alphabetical, the other express or especial. The former is much the more ancient, the latter has proved incomparably the more convenient. No monuments are extant of the musical notation of the Assyrians, Egyptians, or Hebrews. The Hebrew accents now in use are comparatively modern, but it is believed that something like them was in use in earlier times; and accents, if not exactly numerical notes, are akin to them. Musical notations, borrowed from existing alphabets, have long been used in the East. In these the letters were modified to express duration. This was effected by accessory signs. The notation of the Greeks (also alphabetical) was originally very simple, but in later times it became complex, through the increased number of modes, a separate notation for instruments, and generally a more ornate style of music. The Romans,

always imitating the Greeks in art, used the first fifteen letters of their own alphabet for numerical notes. Special musical notation began with the early middle ages. The public libraries of Europe abound with MSS. of the 8th, 9th, 10th, 11th, and 12th centuries, noted in characters not belonging to any known alphabet. These are of two kinds; one formed of little marks, varying in position, each representing an individual sound; the other of lines fantastically bound together, representing groups of sounds. To these two kinds of musical notation may be traced our own—of the perfection and fitness of which he proposed to speak presently. From the detached signs come the long-breve and semi-breve; and from the contorted lines come our groups of quavers, semi-quavers, &c. This ancient notation is known among musical antiquaries as *neuma* notation—a name first given to it by Du Cange. The derivation of modern notes from neumas is not difficult to trace; but the origin of the latter has been a subject of much controversy. Mr. Hullah then gave an account of the theories on the subject, of Theodore Nisard, Kiesewetter, Fetis, and De Coussemaker, giving the preference to that of the latter, who derives neuma, and therefore our present, notation from the three accents of speech—the acute, grave, and circumflex. The first difficulty in respect to this theory lies in our inexact use of the word *accent*, which was generally confounded with emphasis or stress, a part, but not the whole of accent. Ben Johnson calls accent the "tune of speech," a definition in accordance with the derivation of the word. Admitting that accent is something more that emphasis, there is nothing unreasonable in the supposition that characters adopted for the purpose of bringing to mind the tune of speech should have been adopted and improved for fixing the more strictly musical tune of song. From the eighth to the twelfth centuries, during which neuma notation was used throughout Western Europe, it underwent many modifications, the general result of which was its eventual transformation into the square notation still in use for plain song. In the earliest extant specimens of neuma notation may be traced indications of the fundamental principle of modern notation, the expression of relative pitch by relative position. But this expression was for a long time very inexact. Notes were frequently misplaced; and even in their proper places they were often difficult of comparison. The idea presented itself to some acute mind, of drawing a horizontal line, the pitch of which, once agreed upon, would determine that of the notes immediately about it. "Il n'est que le premier pas qui coûte," in arts as in morals. Improvement on this contrivance was easy, all but inevitable. If one line contributed to accuracy, two would be better still; and for some time two lines, distinguished by different coloured inks, were used, an initial letter on each, indicating the notes standing upon it. These were the first clefs. Subsequently a line was inserted between these two; and subsequently again the number of lines was increased to four; this number being in later times greatly increased, and ultimately reduced to the present number, five. The adoption of the stave, by making the places of the notes more easily recognised, soon induced greater accuracy in their forms, certain varieties of which, at very early periods, no doubt indicated different lengths. Like the history of the stave, that of "Time table" might form the subject of many lectures. The very simple proportions of notes to which we are used are the result of ages of experiment. From the end of the 12th century to the end of the 16th, the most extravagant complex means were in use to express even the simplest rhythmical relations; and many rhythmical relations were often anything but simple. Even after much of this intricacy was cleared up, music—even easy music—must have been very hard to read. Till about the beginning of the 17th century music was commonly written and printed without bars. The bar was no doubt used as early as the 11th century, but not to divide notes into measures, but into phrases; in no way answering the purpose of our bar, which, besides dividing notes into equal quantities, incidentally shows to what notes the principal emphases are due. Our word *score* has grown out of the act of drawing bars down the superposed parts of a composition—in fact *scoring* the page. Mr. Hullah then traced the gradual multiplication of the number of forms of notes in recent times, and the modifications to which these had been subjected, not merely in form, but even in colour; and he showed by what simple contrivances, such as the dot and the triplet, the more intricate contrivances of old notations had been replaced. Musical notation had now reached as high a pitch of perfection as could be expected of any human invention. It was understood and accepted too by all who practice the kind of music which it seeks to express—the whole civilized world. This is as it should be. The only universal language possesses the only universal alphabet, and it might have been expected that all who speak the one would unhesitatingly adopt the other. The fact that a symphony, or part-song, composed by a native of France or Germany, can be played or sung by an English orchestra, or a Russian chorus, without chance of any serious misunderstanding, on the part of the latter, of the intention of the former, might be supposed a good *à priori* argument in favour of a means of communion between persons so distant and in many ways so unsympathetic. The fact, too, that to this means of communion men of all nations had contributed something, and that its settlement had taken at least a thousand years, ought to weigh a little with any body who knew how hard it is to get even half a dozen people to settle or agree upon anything. There are continually springing up, however, advocates of new systems of musicography the adoption of which would reduce all our musical heir-looms to the level of waste paper, and most existing musical science and skill to the level of those of these advocates; for it is remarkable that no scheme for the reformation of musicography has ever been proposed by any person of acknowledged musical science or skill. Mr. Hullah then proceeded to pass in review the principal objections to our present musicography—that it occupies much space; that it is laborious to write; and, above all, that it is difficult to read. That many musical compositions occupy much space is not to be denied; but whether they occupy space disproportionate to the wealth of thought contained in them; to the occupation they give to those who have to interpret them; to the sensations, delightful and elevating, which they cause in those who listen to them, are quite other questions. The second objection, that music is extravagantly laborious to write, could only be seriously entertained by people who have never set foot in a great musical library, or opened a great musical catalogue. To the beginner in musical penmanship the art may appear to admit of very slow practice; but experience shows that a fair amount of exercise in it gives a most dangerous facility of expression,—too often turned to account by those who have nothing to express. Mr. Hullah proceeded then to deal with the objection that the present mode of writing music gives unnecessary trouble to those who have to perform it. This he did chiefly by reference to the most elaborate form of music—the full score, wherein was shown the superiority of a pictorial form of expression, such as modern musicians use, to a mere symbolical form, like any of those used in the mathematical sciences. In reference to the reading of a score, he said that if our present mode of writing music were as complex, as illogical, and as clumsy as its adversaries pretended, the reading of a full score must be the most stupendous operation ever achieved by the human intellect. Putting aside, however, all considerations merely musical, and confining himself to the humblest, though not the least interesting of operations—teaching the elements of singing to young children, he said that the would-be reformers of the stave confounded two very different things—the cultivation of the eye and that of the ear; or else took it

for granted that the former was by far the most difficult operation. So far from this being the case, Mr. Hullah's experience had convinced him that the cultivation of the eye was incomparably more easy than that of the ear; and that a very small part, if any, of the difficulties of teaching singing have any connection whatever with the way in which music ever has been, or ever can be, written. It had been taken for granted that the difficulties inherent to the knowledge of sound arose from the difficulties (whether fancied or real does not matter) connected with the use of the symbols which stand for sound. So far from this being the case, they have nothing whatever to do with them. Any person—any child of common intelligence — can be taught in a few minutes that such a note is four positions or "a fourth" from another; but to teach him to utter at will, or recognise when uttered, a sound a fourth above any given sound (written or not written) is a process that requires, and always will require, a good deal of skill on the part of the teacher, and a good deal of time and application on that of the learner. The lecture was illustrated by a large number of diagrams—examples of ancient and modern notation.

SIXTEENTH ORDINARY MEETING.

Wednesday, March 27th, 1867; PETER GRAHAM, Esq., Member of the Council in the Chair.

The following candidates were proposed for election as members of the Society:—

Cassels, Andrew, Manchester.
Eadie, Robert, Blaydon-on-Tyne.
Mendel, Sam, Manchester.
Pagan, John T., J.P., Oak Lodge, Guildford.
Rydon, Horace James, Pyrland House, Highbury Newpark, N.
Tolhurst, John, 152, Tooley-street, E.C.

The following candidates were balloted for, and duly elected members of the Society:—

De Vere, Albert, 86, St. James's-street, S.W.
Ellis, E. S., The Newarke, Leicester.
Elwes, V. Cary, Billing-hall, Northampton.
Kirkbank, John, 10, Gray's-inn-square, W.C.
Knowles, John, 42, Moorgate-street, E.C.
Pearse, Joseph Salter, 18, Barnsbury-street, N.
Potter, Edward, Marine-house, Tynemouth.
White, Henry Hopley, Q.C., the Firs, Rectory-grove, Clapham, S.

The Paper read was—

FLAX, AND IMPROVED MACHINERY FOR ITS PREPARATION.

BY CHAS. F. T. YOUNG, C. E., Mem. Soc. Engineers, Assoc. I.N.A.

Although the especial object of this paper is to treat of the preparation of flax by machinery, it may not be irrelevant to preface it by some observations on the plant itself; and more particularly on the immense importance, in a commercial and national point of view, of encouraging its growth in this country; inasmuch as it might be considered superfluous to speak of the machinery best adapted to its treatment, unless we could previously show that flax itself is much needed, and that it can be very profitably cultivated.

We need not search further than our Bibles for evidence of its general cultivation by the ancient Egyptians and the Israelites; and as it appears that, amongst the latter, the chief portion of the vestments of their High Priest were comprised of fine linen, it is pretty clear that this manufacture of linen from the flax plant had then long existed, and had probably attained to a high degree of excellence, even in those very early days. Nor have we yet discovered any material so admirably adapted, in its purity, freshness, and durability, to the comfort and salubrity of the wearer, more especially in warm climates. Its general estimation naturally caused its cultivation to spread through the world as population and civilization increased, for which the nature of the plant afforded great facilities, accommodating itself, as it does, to almost all climates, although exhibiting, in regard to its fibre-producing properties, a marked preference for the more temperate and humid regions. Hence all the countries of Europe have produced this plant, and there is scarcely one in which it may not be found at the present day. In an early stage of our own country's history we find it to have been almost universally grown. Even yet there are those living who recollect that the flax or hemp croft used to be a component part of almost every homestead; the term of "hempland," still attaching to a certain plot of the farm in some counties, being nearly all that is now left to record the fact.

The importation of cotton into England, in the latter part of the last century, produced a complete revolution in this branch of what might then have been called domestic commerce. With this, gradually, or rather, rapidly, came the wonderful inventions of, and continual improvements in, machinery consequent upon the application of steam power. This necessarily led to the concentration of large manufacturing establishments in those localities which the presence of coal, iron, &c., rendered most suitable for such operations. Cotton, which reaches this country in a condition ready for the spinner's use, had manifestly many advantages over flax, which required much previous manipulation; and the struggles of the latter for a precarious existence, in its simple mode of manufacture, became daily weaker, until at length the primitive spinning wheel—whose cheerful whirr, even within some of our own recollections, was often heard at the cottage-door, supplying a frequent subject for the poet's song and the artist's pencil, and whose gyrations furnished for so many centuries a light and pleasant occupation during the winter evenings to the female inmates of the farm-house, contributing in no trifling degree to the more comfortable support of the family—came to be for ever withdrawn, and the spinning of flax, transferred, at last, from the cottage to the factory, is now carried on almost exclusively in a few of the large towns, such as Leeds, Belfast, Dundee, Manchester, &c. In Ireland, indeed, the struggle has lasted longer, inasmuch as the introduction of cotton manufactures has been by no means so rapid or so successful there as on this side the Channel, and the hand-spinning and weaving of flax has had a somewhat longer existence, but the recent introduction of the power loom for linen weaving can scarcely fail ere long to extinguish the last remnant of the primitive mode of manufacture, and to concentrate the almost entire trade in the neighbourhood of populous towns.

But, although the overwhelming monopoly of cotton has thus conduced, during the present century, to so extraordinary a change in the character of the flax trade, and tended to diminish the consumption of linen, it has by no means annihilated it, while the recent lamentable disruption in the American states, whereby the supply of their valuable cotton has been so enormously diminished, has given a considerable and probably a permanent impulse to our linen manufacture.

Both the spinning and weaving of flax has been carried to much greater perfection of late years by improved machinery; and, if the production of linen goods has not increased so much as might have been expected, the cause is to be traced rather to the deficient supply of the raw material than to the want of demand for the manufactured article.

The cultivation of flax, then, has, for this and many other reasons, strong claims on our consideration. Nevertheless, we continue to allow ourselves to be dependent upon foreign importations for upwards of one-

half of our supply, receiving annually from 60 to 80,000 tons of flax, chiefly from the northern ports of Europe, which could be as well or better grown in our own country, and for this supply we are, of course, dependent upon the continuance of our friendly relations with Russia and Prussia, any disturbance of which would place our flax spinners in the same disastrous position as that recently occupied by our cotton manufacturers.

Surely, then, there is reason in the wish that a better supply of flax could be provided for our spinners from the lands of our own country, and in the idea that the present is a desirable moment for the consideration of so truly national and important a subject; for, though the energy of the American planters is great, it can hardly be expected that, for many years to come, the Southern States can sufficiently recover from the fearful shock they have received, to be able to supply us with anything like the quantity of cotton we received from them previous to their civil war; or that we shall be able to procure it, of that peculiarly useful quality, from other parts of the world; the value of linen, therefore, as a necessary article of household use, must, in all probability, continue to be permanently enhanced.

Let it not, however, be supposed that the importance of this subject arises from the circumstance of the diminished supply of cotton. The scarcity of flax, and the great want of it by the spinners, were acknowledged facts long before the commencement of the American outbreak. Frequent meetings had been held, associations formed, and Government appealed to, with a view to encourage the growth of the flax plant—for fibre—in India, without, however, any successful result; for, indeed, neither in India nor in the American states, nor Canada—where also the subject was brought forward—have they climates half so well adapted as our own to the growth of this plant, so far as fibre is concerned, although, as regards seed it is successfully and extensively produced in India and other places. Still, it must be admitted that the results of the American war have given increased stimulus to the trade, and clothed the subject with additional interest.

In attempting to enumerate some of the advantages of flax cultivation, it may be observed that one very interesting and encouraging feature is, that it forms a strong connecting link between our agricultural and manufacturing interests. This advantage it, indeed, shares with wool, and at least equally deserves the national patronage and support, for what commerce can be so generally desirable for us as that which provides profitable employment both for our farmers and our manufacturers — draws them together by bonds of mutual interest — increases our national capital, and circulates it at home among our own people? We at present send abroad some six millions sterling every year in payment for foreign flax, and seed, &c.; and with this foreign aid our flax-spinners, for many years past, have not had anything like the supply they need, even for their present limited works; but were the growth of flax encouraged as it ought to be, there would be no difficulty in producing it in our own country, to the extent in monetary value of fourteen or fifteen millions, or more, if needed, without any disturbance of the usual agricultural course.

It is not easy to estimate all the advantages which would thus accrue to our country, in an agricultural, manufacturing, and commercial point of view.

Our climate, again, is singularly suited to its growth. Moisture is evidently essential to the healthy production of its fibre. Hence it flourishes so well in Ireland; and this is no slight recommendation to a crop in a climate so humid as ours; indeed it seems a point peculiarly commending itself to the consideration of agriculturists, who may thus compensate themselves for a failing crop of wheat or barley by an abundant one of flax.

The short space of time for which it occupies the land must also be in its favour; being sown in April, it may frequently be gathered in July. It is very true that flax demands care in the preparation of the soil, care in the selection of seed, care in the clearance from weeds; yet these ought rather to be classed among its recommendations than its drawbacks, as such care, while it almost insures a profitable crop, results also in permanent benefit to the land.

As regards the actual return made by a flax crop to the farmer, it is well understood amongst those who have been accustomed to grow it, that the entire expenses of preparing the land, sowing, and gathering, including rent, &c., ought not to exceed £10 per acre, while the average produce of the straw and the seed may be very fairly estimated at £15. Much more than this is frequently obtained; and, of course, from unpropitious seasons, inferior seed, or injudicious management, the result will sometimes be less. In Ireland far more than this is realised by the small farmers, who set their small quantities of flax themselves, and carry their fibre direct to the spinners; but this is a course by no means suited to the English farmer, whose interest it is to sell his straw at once to those who at their retteries prepare the flax for the spinner's use.

Of the value of the seed for the farmer's own use, independently of its worth as a product for sale, it would seem to be difficult to say too much, though here again care is requisite in its administration, whether in the fattening of bullocks, calves, &c., or as an element in the food of horses, or as an aid in carrying lean stock through the winter, or as nourishment for ewes in the lambing season, and in all these cases returning most valuable manure to the land; but so much has been said on this subject by Mr. Warner and other practical writers, that it would be superfluous to go into further details.

Having said thus much on the advantages of this crop, it may be well to touch upon the objections which have been sometimes advanced against it. These are chiefly limited to two, viz., its supposed exhaustion of the soil, and its interference with the harvesting of other crops. The former objection has indeed been often made; it is as old as the days of Virgil; and it is quite possible that, in the then state of agricultural science, there might be reason for the charge of its "burning" or exhausting the land. This was the natural result in our own country previous to the introduction of the system of a rotation of crops, and of restoring to the land, by natural and artificial manures, those inorganic substances which the plants had extracted from it. Flax and hemp were both grown formerly as articles of domestic necessity, without reference to the nature of the soil, and with little or no aid from manure, the small stock of of which was of course reserved for the grain or food crops. It is not unnatural, therefore, that a crop thus grown constantly on the same land should have come to be looked upon as exhausting, but it is now well-known that, where attention is paid to the suitable nature of the land, and due care bestowed on its treatment, flax is, in proportion to its value as a crop, less exhausting to the land than several others which are regularly grown. Experienced farmers admit that, on suitable land, it creates no undue impoverishment, while it leaves the soil in a peculiarly good condition for the succeeding crop. Nay, it has been grown (although such a course is by no means recommended) on the same land each alternate year for eight or ten years, without producing any symptom of unhealthy exhaustion, the grower having, in fact, almost every year carried away the prize for the best crop of flax grown in that particular neighbourhood.

It would perhaps be an interesting point to attempt to ascertain how much more a plant of such rapid growth as flax owes to water and to atmosphere than it does to the soil in which it grows; and surely there is nothing in the character of its roots or in the quantity of its seed to demand any unusual degree of absorption from the land, although it may possibly extract some properties which, if we could have our entire will, we might wish

to retain for a subsequent crop; but even in such case no injury can accrue, as, from the small quantity of land which it is desirable to appropriate annually to flax, viz., one-twentieth part only of the arable portion of a farm, so many years would elapse before the crop returned to the same plot, that any idea of injury from exhaustion is utterly out of the question.

The objection of its interfering with other harvesting operations, will not, as a general rule, be valid, under proper management. If the land be in good heart, the seed of the right kind, and sown before the middle of April, it will usually be ready for pulling about ten days before the general harvest. Flax from Dutch seed is indeed of slower growth than that from Riga seed, and has often been the cause of this annoyance, having been frequently used on account of its larger yield of seed. It should, however, be carefully avoided, not only on account of its more tardy maturity, but because the fibre extracted from it is comparatively worthless. Again, if the quantity grown be restricted to the proportion above stated, this is of itself almost a sufficient security against any inconvenient interference with other harvest work.

Here, then, it may possibly be asked—If the growth of flax be so desirable for the linen manufacturers, and so remunerative to the growers, how comes it that so little is produced in England?

Several reasons may be given:—

1st. The impression entertained that it exhausted the soil, and that, being pulled up by the roots, it left nothing on the farm in the shape of either stubble or straw, led to the introduction of a clause in the old leases prohibiting its growth; and although this prejudice may be said to have all but passed away, there are, even yet, some few landlords so strongly wedded to all the systems of their forefathers, without troubling themselves to ascertain their origin, or to weigh their merits, or to reflect upon their consequences, as still to continue this impolitic prohibition.

2nd. The remunerative price of wheat and of live stock in past years, caused farmers to be little inclined to experiment upon a plant of which the present generation knew little, except that it had almost ceased to be grown; and that, therefore, even where it was not prohibited, there were, probably, sufficient reasons, without troubling themselves to analyse them, why they should not attempt to reintroduce it. The present times, however, seem to militate against these easy-going conclusions. The increase of railways in the great corn-growing countries of the Continent is greatly facilitating the importation of both wheat and cattle into England, so that corn, except it be, as in the past year, of almost universal extension, will scarcely now hold out its *dernier* consolation of enhanced price. Wheat, therefore, no longer holds its former high position in the farmer's estimation; and the cultivation of so remunerative a crop as flax, though grown to a less extent, would be found a most important addition at the year's end, to his sources of income.

3rdly. And this is perhaps the most cogent reason—the want of a market for the flax when grown. There would be no wisdom in a farmer growing flax unless he had a ready means of disposing of his flax straw as well as of his flax seed. In Ireland, as previously mentioned, the holdings being generally very small, the farmer steeps and dresses his little bit of straw for the spinner by the manual labour of his own family and where the growth is larger he can carry it probably to a not far distant scutch mill, of which there are a good many hundreds spread over the country. In England a farmer generally holds as much land as he can manage; and to fetter himself with the intricate operations of steeping, drying, rolling, and cleaning his flax, on any considerable scale, would be not only very difficult and irksome, but probably from want of the necessary skill and care in the various operations, very unprofitable also. Sufficient for him is the growing and selling it at a remunerative price. It is therefore absolutely necessary, as a concomitant to the growth of flax, that retteries for cleaning it should be established in the various parts of the country where it is produced, on a scale sufficient to be able to purchase the flax grown within a radius of about 10 miles, this being about as far as it would be desirable to cart it. Wherever such retteries have been established and prudently conducted, they have given very profitable results, and have conferred great benefit upon the agriculturalists of the neighbouring districts by purchasing their flax, and thus encouraging its cultivation; and it is clear that the subject only requires to be better and more generally understood, to lead to a much increased development of this very interesting branch of trade. It is true that in cases where such works have been undertaken by persons without experience, without the necessary machinery, disappointment and failure have resulted; but there is perhaps no branch of trade which holds out a greater assurance of profitable return at the present moment than a flax rettery judiciously conducted upon well-arranged principles, and furnished with the machinery best adapted to the purpose of thoroughly and economically preparing the flax fibre for the spinner's use.

And this brings us to the point which we should probably have reached sooner, had it not seemed reasonable that, before treating of the machinery best suited for the preparation of the flax we should endeavour to establish the position that a greatly increased production is really needed by the spinner, and that it would be very remunerative to the grower, as well as a source of much good to the public at large.

It may seem singular, at first sight, that more rapid progress has not been made in the successful adaptation of machinery to this object; there is, however, a very peculiar nature, subtlety, and delicacy, about the flax fibre, which renders its judicious treatment a matter of no ordinary nicety and of no little study, and which demands the greatest care in every stage of its manipulation. There has indeed been no lack of machines introduced for this purpose; but, up to the present time, the result of most of them has been very unsatisfactory.

Although it is generally known that the thread from which linen goods are made is obtained from the flax plant, it is believed that a very small proportion of the inhabitants of England ever saw flax growing, and that a still smaller proportion have any clear idea by what processes it is prepared for the manufacturer. It may indeed be quite unnecessary here to enter into explanations of this nature; yet the remarks upon the machines themselves would scarcely be intelligible, unless preceded by some account of the work they have to perform.

These processes then, after the plant has been pulled up by the roots, and allowed to dry in the field, are as follows:—viz., seeding, steeping, rolling, drying, stacking, breaking, scutching, and sorting.

1. The first process, that of taking the seed from the plant, is effected by holding the root ends of the sheaf in the hands, and whipping the seed ends a few times quickly between two iron rollers, so fixed that one end of the roller remains open for the free passage of the straw, and set close enough to each other to crush the bolls and allow the seed to fall out without doing any injury to the seed itself. This is a very simple and useful machine, and a great improvement on the previous methods of thrashing or rippling.

2. Then comes the steeping or retting process, still carried on, in some places, in sluggish streams, and in others in pits formed by the aid of streams. By this means however, flax can only be steeped in the warmer months of the year, and even then the variations of temperature, render it a very uncertain and tedious operation, occupying from ten to twenty days, according to the state of the weather, and often very imperfectly performed. The object of steeping is to produce such a degree of incipient fermentation, as may soften and remove the glutinous matter, and facilitate, in the sub-

sequent processes, the separation of the fibre from the woody portion of the plant, guarding at the same time against proceeding so far in this operation as to injure the nature and strength of the fibre. This, on a manufacturing scale, is done by means of large vats, in which the water is maintained at one uniform moderate temperature at all seasons, and the process, though requiring watchfulness and care, is accomplished without any uncertainty, and with an immense saving of time.

3. As soon as the straw is sufficiently, and not more than sufficiently steeped—a point of the greatest importance, as on it rests, to a great extent, the ultimate value of the flax—instead of being carried at once to the drying ground, the sheaves are opened, and passed through a machine having several pairs of heavily weighted rollers, with a copious shower of water, falling upon them in their passage through it. By this washing and pressure a large quantity of green glutinous matter is extracted, the release of the fibre from the epidermis and from the stem facilitated, and the fibre much improved in colour and quality. For this washing and rolling process obligations would seem to be due both to Mr. Watt and to Mr. Pownall.

4. The next process (drying) must be atmospheric. Every rapid mode of artificial drying has been found prejudicial to the strength of the fibre; and any lengthened process, by steam or otherwise, would, even were it practicable, involve the necessity of too great an extent of covered space. Spreading on the fields and turning is the usual mode; but the use of horizontal wires, at 18 or 20 inches from the ground, supporting the flax, with its root ends only resting on the ground, insures a great saving both of time and space.

5. When dried the straw should be carefully tied up in sheaves and stacked, and it is desirable that it should so remain for two or three months. It seems thus to recover its nature, and to acquire a mellowness and quality which enhances its value, and also renders it easier to clean.

6. Then comes the separation of the fibre from the woody part, as a preparation for which the flax is passed through what is called a breaking machine, having several pairs of fluted rollers. The intention of these is to crush and break the stem into small portions, and so loosen it from the fibre, that the next process—the scutching, or actual removal of all the woody part—may be comparatively easy; but in this very essential point—a point on which the successful treatment of flax would seem to depend—these breaking machines hitherto appear to have signally failed, and it is more than probable that it is from the want of a better principle at this particular point of the work that many have been deterred from entering upon this really interesting occupation, and that thus the cultivation of flax has been indirectly discouraged.

It must be premised that the essential principle in cleaning flax is to do it without injury to, and without waste of, the fibre. Now, every process of scutching, as the term implies, is by striking the flax; and it is very difficult indeed to give a blow of any kind to this fibre without either breaking some portion of it, and thus converting it into tow, or, if not actually breaking it, so chafing and weakening it as sensibly to diminish its value. Hence the introduction of the breaking machine. Its object was good, but the inventors have failed to accomplish their intentions. It should have absolutely removed a large portion of the shive, or woody matter, and have so broken and loosened the remainder that in the subsequent scutching there would be very little to do, for it must be borne in mind that it is not in the breaking, but in the scutching, that the tow is made. The former, therefore, should have done nearly all the work, merely leaving it to the latter to give the finishing stroke, but in this it has substantially failed. The action of the breaking machines in general use simply flattens, softens, and bruises the woody stem, but it does not remove it. The scutcher, therefore, still has this to do, and in doing it, whether making use of the Irish stock or any other mode, he contrives—not from any fault of his, but from the nature of the machine he uses—to convert so much of the fibre into tow, or to leave so much of it adhering to the broken straw, that the average yield of finished fibre from a ton of green straw is generally calculated at about one-eighth part, *i.e.*, that it requires about eight tons of green or unretted straw to produce one ton of flax fibre.

Now the natural yield of fibre from the stalk of the flax plant is about 1 in 4½; in other words, if it were possible to preserve every particle of fibre, without any loss whatever in the process of cleaning, it would require about 4½ tons of green flax straw to produce one ton of finished fibre.

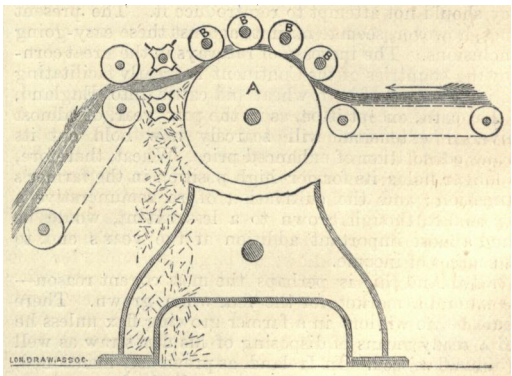
Surely, then, there exists here a wide margin for improvement. It would be an unnecessary trespass on your time to attempt to enumerate the various machines, with their numerous and ingenious contrivances, to accomplish this seemingly easy, but in reality delicate and difficult operation of cleaning flax. Some have been too costly, others too complicated, others too severe in their action, all too limited in their yield, and all failing to demonstrate the fundamental principle, that the main separation of the woody portion from the fibre must be made while the flax is retained in such a position in the machine as not to admit of the possibility of any considerable portion of tow being torn from it.

Now, this most desirable consummation has at length been achieved; and it is to this striking and most important improvement that your especial attention is now requested.

The breaking machine, a model of which is on the table before you, has been constructed by Mr. Brasier, a practical engineer, who has had a large experience in flax machinery, and whose sagacity and reflection led him to the conclusion that the scutcher was a most wasteful machine as hitherto applied, and that the work of separating the fibre from the shive must be mainly, if not altogether, accomplished by the breaker, which makes no tow, and not by the scutcher, which makes a great deal.

The machine, as you will observe in Fig. 1, consists of

Fig. 1.



one large fluted cylinder or roller, A, on which work four small rollers, B, B, B, B, also fluted, resembling somewhat in this respect the construction of the cotton-carding engine. The object of these rollers, like that in all other breaking machines, is to crush and break the woody part; but in order to accomplish this much more effectually than any other has succeeded in doing, a reverse motion, shorter in duration than that of the forward motion, is added, so that the gradations are, in fact, a long forward motion and a shorter reverse motion, a second forward motion and a second reverse, and a third forward motion, which carries the ends of the flax on to receive the ac-

tion of four small beaters fixed upon a horizontal axis' which, revolving continuously in one direction, thus obtain a double relative action on the flax during the time that it is drawn backwards and forwards by the compound action of the rollers.

The principle upon which this reciprocating motion is given is to be found in the natural movement employed by the human hands in rubbing out the husk from any other matter by which it is surrounded, or which it surrounds; thus, in rubbing out corn from the chaff by hand, you naturally give a reciprocating motion to the hands, and in breaking flax straw from the "shive," exactly the same movement is almost involuntarily given which is imitated in the present machine.

Thus, to a great extent, the combined action of a breaker and a scutcher is comprised in this very ingenious machine, and so happily that, while a very great proportion (about three-fourths) of the shive is actually removed from the flax, and the remainder so loosened as to be very easily cleared away in the subsequent process, the cleaning action performed by the beaters is effected while the flax is being held in such a position by the rollers as to prevent the formation of any appreciable quantity of tow, and the dust of the scutching mill, which is so prejudicial to health, and so annoying on the present system, is entirely done away with by the use of this machine.

There are other merits in the construction of the machine which can scarcely be represented by the model, the object being to make the working as smooth and true as possible, with the smallest possible amount of power, which does not exceed that of one horse; while the quantity of flax straw which the machine has been tested to operate upon in the day of ten hours, attended by three boys or girls, is about 80 stones of 14lb.

In speaking of the results of this machine, it may be stated that it has been now at work for many months, during which it has been brought to its present state of efficiency, and that there has therefore been ample time to judge of its practical utility.

The average of the trials made from straw purchased in the dried or retted state, is as follows:—

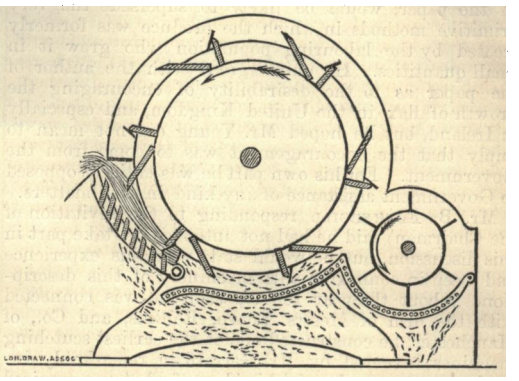
100 lbs. retted straw yields of scutched flax	25·50
It also yields of long tow 7 lbs. = 39 per cent. of flax	2·72
And of short tow 3lbs. = 26 per cent. of flax	·78
	29·

Now 100 lbs. of retted straw represents about 150 lbs. of green straw, about one-third of the weight being lost in steeping and drying. Therefore, a yield of 29 lbs. flax from 150 lbs. green straw equals one ton of flax from $5\frac{1}{7}$ tons of straw, instead of the general average of one ton of flax from 8 tons of straw, making a difference of $2\frac{2}{7}$ tons of straw in every ton of finished flax. But supposing we allow a large discount for too favourable experiments on cwts. as compared with actual trade results when working by tons, and, instead of calling the yield one ton of flax from $5\frac{1}{7}$ tons of straw, we call it one ton of flax from six tons of straw, we have still a saving of two tons of straw in every eight, or 25 per cent.

It must also be borne in mind that the saving of one-fourth part of the flax straw would not be the only advantage, but the labour also on a fourth-part less quantity of the raw material, which on so bulky an article is very great.

The machine, however, which has been just described, it must be remembered, does not profess to be a scutching, but a breaking machine, although it does, in fact, possess, to a very considerable extent, the attributes also of a scutcher. Its inventor has, therefore, after a thorough examination of the various machines, now, and at former periods, in use, for this last operation of scutching, constructed a machine (Fig. 2) which seems to be all that need be desired to complete the process.

Fig. 2.



One feature in this scutching machine is the construction of the stock, which is so hinged and balanced that, by an almost involuntary action on the part of the operator, the amount of blow given to the flax under operation, can be perfectly regulated, and thus all loss from undue severity, entirely obviated. It has also the following great improvement attached to it.

It has already been stated that all scutching machines must necessarily make some amount of tow. To this machine, then, has been connected a contrivance (shown at the end of the machine) for at once catching the tow, freeing it from the adhering "shive," and thus delivering at the same time, but from opposite sides of the machine, the flax and the tow—both cleaned.

One other very important advantage of the combined use of these two machines must not be lost sight of. The present general mode of scutching flax by means of the "Irish stock" involves the necessity of employing skilled labour, and the workman who with this machine turns off his three or four stones of flax daily is in the receipt of some 20s. or 22s. per week, the result being that, by this process, the cost of scutching is from 12d. to 14d. per stone; whereas, by the use of these two machines of Mr. Brasier, worked by youthful and unskilled hands, the cost per stone would not exceed 4d. to 5d., independently of the great saving of fibre already alluded to. Touching the last process—"sorting the flax for market"—as no machinery is required, no special notice seems to be needed.

Briefly to recapitulate, then, the advantages to be obtained by the use of these machines, we have:—

1st. The saving of 2 tons in every 8, in the cost of flax straw.

2nd. The saving of the labour on these 2 tons.

3rd. The saving of 7d. to 8d. per stone in the breaking and scutching.

4th. The employment, in this last process, of unskilled, instead of skilled labour, the importance of which manufacturers at least will be at no loss to appreciate.

In conclusion, the author would remark that the foregoing observations have been approved by one who has had a considerable practical experience in the preparation of flax, though not now engaged in it, and who has, moreover, no pecuniary interest whatever in connexion with the machines; but who, having suffered from the imperfections of those hitherto in use, and having satisfied himself, by personal inspection, of the advantages of those which have now been but imperfectly described, is well able to give an opinion; he therefore considers it but right to give this public testimony in favour of an invention which he believes calculated to confer very important benefits upon an exceedingly interesting, though hitherto too little appreciated branch of British agriculture and British commerce.

DISCUSSION.

Mr. BOTLY said he should be happy to learn that the machines, of which an explanation had been given in the paper, would be likely to supersede the very primitive methods in which the produce was formerly treated by the labouring population who grew it in small quantities. He quite agreed with the author of the paper as to the desirability of encouraging the growth of flax in the United Kingdom, and especially in Ireland, but he hoped Mr. Young did not mean to imply that the encouragement was to come from the Government. For his own part he was entirely opposed to Government assistance of any kind in such matters.

Mr. B. FOTHERGILL (responding to the invitation of the Chairman) said he had not intended to take part in this discussion, but he would state what his experience had been in connexion with machinery of this description. About the year 1834-5, when he was connected with the firm of Messrs. Sharp, Roberts, and Co., of Manchester, he constructed one of the earliest scutching machines invented by Mr. Gerrard, a remarkably ingenious man, who derived his ideas of what was required in these machines from observing his wife combing her hair. Observing that if the comb were introduced into the hair near the roots, entanglement ensued, and there was a tendency to tear the hair, but that if introduced near the ends, and gradually carried higher up, no such entanglement took place, it occurred to him that machinery for the combing of flax should be made to operate upon the same principle. The invention of Mr. Gerrard proved very successful, but unfortunately the machine possessed the fault to which reference had been made in the paper, namely, that in this operation, the fibre was broken to a considerable extent, and a great quantity of tow was produced. After that another machine was invented, which was shown at work in the Exhibition of 1851, and patented by Mr. Plummer, of Newcastle-on-Tyne. That was an excellent machine and a great improvement upon all contrivances with which he was acquainted up to that time; but as he (Mr. Fothergill) had now left Manchester for several years, he had got out of the sphere of the flax, cotton, and wool trades, and he had not followed up the history of invention in connection with those industries. He might mention that his father started the first flax mill in Darlington before the commencement of the present century, and with the assistance of his (Mr. Fothergill's) two brothers, machinery for the preparation of the fibre was set to work. At that period they had a contrivance, something analogous to the second machine described by Mr. Young, for operating upon the flax. Still there were the defects with regard to the breaking of the fibre, to which reference had been made, and from that time to the present those defects had more or less existed in all the flax machinery that had been introduced. He, however, thought the combination of the fluted cylinder having fluted rollers, as in the first machine described by Mr. Young, with a reversing action, must be ranked amongst the best contrivances in respect of machinery of this description. The only doubt he had with regard to the machine now before them was whether or not there was a tendency to carry over some of the loose fibre, and thus cause entanglement and waste. If this did not happen he congratulated the inventor on having produced a contrivance which, in his (Mr. Fothergill's) opinion, would well answer the purpose. With regard to the second description of machine, he thought that was somewhat of the character of a modification of the Oldham "willow;" but there was a point in connection with it on which he would ask a question, viz., whether the tow which came from the flax was carried forward and delivered at the other end of the machine in a confused mass of long and short together. If so, he thought the introduction of a second cylinder, to separate the long from the short lengths, as in the carding machine, would prove an advantageous addition.

Mr. CONISBEE said he was at present constructing a flax-breaking machine, under the patent of Mr. J. Hill Dickson, but it differed from that on the table, inasmuch as it had a horizontal reciprocating action; and he considered it a far superior machine to that described by Mr. Young. There was in the machine he had alluded to, a table, constructed like a gridiron, with open bars. The cylinders were four in number, and each cylinder was placed on a separate axis, furnished with pressure springs, so that it could act upon four different streaks of flax at the same time. All the straw fell through the gridiron; and he could state, from his own knowledge, that a machine of this kind, 12 ft. long, did not make a pound of tow per day. The flax was passed gradually along the table, and every portion of the straw was exposed to different pressures, produced by rollers of different pitches, till every part of the woody substance was broken out, while the fibre remained entirely unbroken. He had not tested the actual quality of work done by this machine, but his impression was, that as two persons could be employed in feeding at each end of the machine, it would be capable of doing double the quantity of work which the machine before them could do.

Mr. CREWE said that the machine before them appeared to him to be a combination of the American jute softener with the ordinary flax-breaker. It was impossible to get a good preparation of the fibre unless proper attention was paid to the retting; and in many parts of Yorkshire there were pits on common lands to which the people had access for that purpose; but unless the steeping was done at the proper time the fibre became weak and a great quantity of tow was made.

Mr. JOHNSON WILSON said, having acted as consulting engineer to the member for Fifeshire for several years, during which time he had erected and managed large works for the manufacture of flax straw, consuming the produce of about 800 acres of land, and producing about 3,000 tons of flax per annum, he might be permitted to offer a few remarks on this subject. He had found no difficulty in getting farmers to grow flax; in fact, most of them liked that crop very much. The yield of the crop was very fairly stated by Mr. Young, the average being from £14 to £16 per imperial acre. Sometimes it might be as low as £10; at others it was as high as £18 and £20 per acre, when grown on suitable soil. There was, in the case to which he referred, an excellent market for the seed to the linseed crushers, who readily purchased at a certain price per bushel all the seed that could be produced. It was the seed which extracted the most from the soil; the fibre really took almost nothing, but if the farmers used the linseed cake for their cattle, a great portion of it was returned to the soil in the shape of manure. The straw was often brought from greater distances than ten miles; frequently 20 and even 50 miles; in the latter case by railway. Improvements in the steeping had been introduced which increased the value of the flax very much. This operation was performed in a large vat house, and the fermentation of the straw was promoted by the introduction of a small running stream of warm water, in imitation of the Courtrai system, and this was found to increase the value of the flax very much, as it washed away the greater portion of the gum as well as promoted fermentation. Flax manufactured at these works had been sold at £130 per ton. As had been remarked by the author of the paper, the scutching had always been the great difficulty in the manipulation of flax, and he believed that had been the principal barrier to the extension of its cultivation. He had brought with him a return of the average results of several years' working, which would be found to be as follows:—

COST.

	£	s.	d.
10 tons of straw, at £3 10s.	35	0	0
Stacking	1	0	0
Seeding	2	10	0
Steeping and drying seven tons	1	15	0

	£	s.	d.
Scutching	8	10	0
Sorting and baling	1	5	0
	50	0	0

YIELD.

50 bushels of seed, at 5s.				12	10	0
200 bushels of chaff, at 3d.				2	10	0
One ton of flax				60	0	0
Three cwts. of tow, at 5s.				0	15	0
				75	15	0
Less cost as above	50	0	0			
Office, fuel, repairs, mill stores, &c.	4	0	0			
				54	0	0
For interest and profit				21	15	0

He considered this to be a fair profit upon the manufacture, and he was of opinion that it was a trade which ought to be extended in this country. If the Government offered a prize of £1,000 for a perfect scutching machine, the advantages, especially to Ireland, would be very great, and would be well worth the money; and, he thought, if landowners saw their way to the manufacture being easily and successfully conducted, it was a crop so suitable to this climate that it would become very extensively cultivated.

Mr. FOTHERGILL suggested that an improvement would be effected in the machine now before them if the rollers, instead of being fluted straight across, were grooved in a spiral form, as he thought this would tend to break off the shive in shorter lengths, and the shorter they were the better.

Mr. D. ROBERTON BLAINE said, with regard to the agricultural part of the question, he understood from the paper that the cost of producing flax to the farmer was something like £10 per acre, but it did not seem to be clear what was really the profit to the farmer per acre. He apprehended that the success of the crop depended very much upon its being grown on a soil suitable for it. From all they had heard there could be no doubt that our climate was well adapted for its cultivation. A good deal of flax, he believed, was produced in the east of Italy, where the soil was light, and there was a good deal of water; and travelling in those parts one saw the ditches filled with flax, steeping in the rough mode adopted there. He entirely agreed in the opinion expressed as to the extreme desirability of promoting the extension of the cultivation of flax in this country; but it came in the end to the question of the amount of profit at which it could be carried on in comparison with the ordinary grain and root crops.

Mr. JOHNSON WILSON thought Mr. Young had rather overstated the cost of production at £10 per acre. He thought it was under that, including rent, so that there was a profit to the grower of between £4 and £5 per acre. The best quality of flax was that grown on a loose soil, with a clay bottom, the woody portion of the straw being very thin. When grown on a light gravelly soil the reed was strong, and the fibre light and deficient in quality, and a great deal of seed was produced. The flax cultivation in Fifeshire received a check during the period of the Russian war, owing to the high price of wheat, but it had been again taken up there.

Mr. G. B. GALLOWAY spoke in favour of the more extended cultivation of flax, a produce which had so important a bearing upon the commercial interests of the country. He did not agree with the first speaker in his condemnation of Government assistance and encouragement of inventions. In his opinion, if more assistance had been given to inventors this country would have been even greater and richer than it was now.

Mr. WOOD (responding to the Chairman's invitation) said not being a flax manufacturer, and having no special knowledge on this subject, he could not add anything upon it. With respect to what had just been said on the question of Government patronage of inventions, he might say he had been an inventor for 30 years, but he repudiated wholly any government patronage. Inventors should be content to stand or fall by the merits of their inventions. All he asked was that the Government should let them alone.

Mr. CAMPIN, on the subject of government patronage to inventors, said it seemed to him, however undesirable such a patronage might be in a general point of view, yet in matters of great national importance they were not without instances of good results having accrued from such a course.

Mr. BISHOP remarked that when travelling in Italy he observed that in spots where sunken lakes existed in extinct volcanoes, the people chose that water in preference to any other for steeping the flax in, and from inquiries he made he found that that preference was owing to the benefit which the flax appeared to receive from the chemical ingredients with which the water was charged.

Mr. JOHNSON WILSON said everything which tended to keep the water sweet during the process of fermentation was beneficial to the flax.

Mr. HANCOCK said, in addition to the question that had been raised as to the average profit realised by the produce of flax, there was another question, which he thought had an important bearing upon the case—viz., whether flax must not be regarded as an uncertain crop. He recollected, when travelling in the north of Ireland, that great anxiety was felt as to what the produce of the next flax crop would be; and he believed the difference between the yield of one year and that of another was very considerable.

The CHAIRMAN begged leave to propose a vote of thanks to Mr. Young for having brought this subject before them, and for the able manner in which he had dealt with it. No doubt it was a question very important to agriculturists and also to manufacturers. The extent to which flax might be cultivated in this country must, in a great measure, depend upon the facilities which the neighbourhoods afforded for getting the produce to the market. No doubt railways had greatly contributed to those facilities, and might make flax a profitable crop now where it was not so formerly. It was also necessary to be within reasonable distance of seed-crushing establishments; for though the seed might be used as food for cattle without crushing, by mixing it with chaff, still the most profitable use of it was when the oil was extracted by crushing, and the cake used as cattle food. With regard to the economy claimed by Mr. Young in the use of the machines he had described, it was stated that that which cost about 14d. per stone could be done for 5d. by this machine; if so, that was an enormous economy; and from what he had seen of the operation of the model the work appeared to be well done and the fibre uninjured. Certainly, if this machine were as successful as it appeared likely to be, it would sufficiently remunerate the inventor, irrespective of any patronage or aid from Government. His own opinion was that prizes offered by Government would never lead to important inventions. Any premium which the Government could give for a really valuable invention would be insignificant compared with that which would be derived from its commercial success. There had always been great difference of opinion on the subject of the Patent Laws, and he was not going to enter upon that this evening further than to say that in his judgment, if they could not be maintained on the ground that they were for the benefit of the country generally, and not merely of the inventor, he did not think they could be upheld. He was sure the meeting would agree with him that Mr. Young was entitled to their cordial thanks for his paper.

The vote of thanks having been passed,

Mr. YOUNG acknowledged the kind manner in which his communication had been received by the meeting. He thought it most important that local agricultural societies and landowners should stimulate the growth of flax in this country. The severe lesson which we were

taught by the late American war, in reference to cotton, was, he thought, sufficient to show the importance of our being as far as possible independent of foreign countries for raw materials of this character. He had been much gratified by the approval of this machine which had been expressed by so eminent a practical mechanician as Mr. Fothergill. The work done by the little model before them bore no comparison to what the machine itself effected. It merely served to illustrate the way in which the thing was done. With reference to Mr. Conisbee's remarks he (Mr. Young) was happy to hear that Mr. Dickson, who had been trying his hand at this matter since 1851, had at length arrived at what he regarded as a successful result. He was informed that the weight of that machine was from six to eight tons, while that he had described weighed only about 5 cwt. The objection he had heard to Mr. Dickson's machine, so far as he understood it, was that it required that the flax should be passed through it twice to accomplish the complete breaking of the shive, only one side being broken at a time, whereas, in the machine he had described, the straw might be passed through very rapidly, and the process of breaking the shive was thoroughly effected by one operation. He agreed with the Chairman as to the great importance of growing flax where there was easy means of access to and from the mills. He might add that one great point in favour of the machine he had described, as regarded its application in agricultural districts, was the fact that it entirely dispensed with the necessity for skilled labour. With regard to what had fallen from Mr. Hancock, he did not think flax was a more uncertain crop than any other. The ground might be unsuitable, and an unfavourable season might retard the crop and lessen the yield, but it was no more uncertain in that respect than wheat, or any other crop. To return to the subject of the machine, the figures he had given were not the result of experiment only, but of actual work done by it. He had seen it in working for several months, and he was altogether so pleased with its operation, that, without having the slighest pecuniary interest in it, he was anxious that it should be brought before the public, and he had taken that task upon himself.

Proceedings of Institutions.

PENDLETON MECHANICS' INSTITUTION. — The sixteenth annual report states that considerable progress has been made. The finances of the Institution bear a more favourable aspect; the receipts have been £280 8s. 8d., and have exceeded the expenditure by £65 0s. 0½d., thus reducing the debt to £80 11s. 3d. During the year the directors have lost the services of some active members of the board by change of residence. The loss of the services of Mr. C. D. Cartwright and Mr. Allcock is especially regretted. The number of members of the Institution is 235, an increase of 62 on the former year. In the female class, which is taught gratuitously by the Misses Phillips, the pupils make rapid progress. The number on the books is 24; the average attendance 16. In the adult male class the attendance has been very satisfactory. The number on the books is 40; the average attendance 20. The juvenile male class has been well attended. Particular attention is given to imparting a fair handwriting, and the reading lessons are chiefly in English History. Elementary arithmetic is also taught. The number on the books is 29; the average attendance 18. In the drawing class the number on the books is 13; the average attendance 9. In the French class, the number on the books is 15; the average attendance 8. The chemistry class has been taught by Mr. Hartley, a Government science teacher. The number on the books is 11; the average attendance 7. In the short-hand class, which is of comparatively recent establishment, the number on the books is 10; the average attendance 6. The total number of members who joined the gymnasium during the year is 87. The number of volumes in the library is 1,657, being an increase of 31 volumes over the previous year. The average number of volumes issued per month has been 252.

PARIS UNIVERSAL EXHIBITION.

The opening of the Exhibition is officially announced for the first of April; no particulars are added, but it is understood that there will be no state ceremony. A large number of workmen are employed in getting the grand vestibule ready for the opening day; the wood work of the two sides, which form the boundaries of the French and English sections, is finished, with the exception of the last touches of the decorator; and the stained glass of the two countries begins to make a very handsome show; that which is already in place is fine in colour, harmonious in tone, and solid as regards method of treatment These windows will bring French and English artists into direct competition, and, judging by what is now visible, each has a formidable rival in the other. The clerestory windows of the vestibule are admirably adapted for the purpose in every respect, though of course the two sides are not equally advantageous as respects light.

The two commissions are naturally intent on showing some of their choicest specimens at this spot, and the sides of the grand vestibule will be occupied, to use the old exhibition term, by series of trophies. The most conspicuous for the moment is a collection of casts of decorative sculpture, from South Kensington; the reconstruction of the celebrated pulpit by Nicolas Pisano the younger; portions of the famous *Gloria* of St. Iago in Spain; and a Venetian tomb.

The machinery in the British department is now getting into something like order, but there still remains a great deal to be done before many of the machines are ready for work. The boiler house is now practically finished, and the steam piping, shafting, &c., nearly completed.

The American coal-burning locomotive, with its boiler and chimney covered with German silver, is now completed. The driving and trailing wheels are 5ft. 6in. in diameter, and are coupled together. The front part, with its cow-catcher, is mounted on a four-wheeled truck. The tender is also on two four-wheeled trucks. The cylinders are outside, 16 in. in diameter, with 22 in. stroke. The "cab," or housing for the engine driver, is in polished wood, in true American fashion, and is well finished. The rails upon which the engine stands are laid with Dering's patent rail-fastenings.

The Chemin de Fer de l'Est send one of their two-storey carriages, to accommodate eight passengers, first, second, and third class.

The English barrack hut is now being fitted up. It contains compartments for the exhibition of various articles of barrack and hospital furniture and fittings, and contains specimens of a soldier's barrack room, lavatory, sergeant's or married soldier's quarters, a troop stable, recreation room, hospital ward, and offices attached to the hospital.

In the Swiss annexe, Messrs. Escher, Wyss, and Co., of Zurich, have completed a pair of 120-horse power engines, for lake or shallow river navigation. Here also is exhibited a good deal of agricultural machinery.

The Dutch are exhibiting a great deal of railway plant in a building for that purpose in the park.

In the French marine engine building are the three cylinder 960-horse power engines for the *Friedland*, made at Indret. Four of the boilers are being fixed. The cylinders are 82½ in. in diameter, with 5 ft. stroke. The propeller is four-bladed, 19 ft. 6 in. in diameter. These engines will be employed during the Exhibition for the purpose of pumping water from the Seine to supply the fountains, &c., in the park.

The English marine engines are not so forward. Messrs. Penns' screw trunk-engines, of 350-horse power, are at last being erected. The Société John Cockerell, of Seraing, are putting up a large vertical blowing engine with 9ft. cylinder.

In the way of decoration the iron work of the British section is being relieved with gold lines, which will harmonize well with the olive-green colour of the iron, the rich dark crimson draperies, and the black and gold of the majority of the cases. But the most novel and characteristic piece of decoration is that adopted by the British commission for the eighty great windows of the machinery gallery; these are being rapidly filled with transparent blinds, stretched on frames, each recording the fame of a British inventor or improver. A picture of the machine itself occupies the centre of the blind, and above and below is the description of the invention and the name of the inventor, with dates and other particulars. A better method of staining this immense range of windows could hardly have been adopted, and the list will supply a remarkable chapter in the catalogue of the English section of the exhibition.

The collection of books, periodicals, and newspapers published in the United Kingdom and its dependencies in the course of the year 1866 begins to attract attention; it is one of the noblest exhibitions that Great Britain can make, the only drawback being that in this case it is impossible to show much more than names and titles. But Dr. Johnson said that the next thing to having read a book was to know where to find it, so that those who are not yet acquainted with our literature will at any rate have an opportunity of learning something about it this year. One branch of the subject, that of illustration, is well exhibited by specimens under glass. The books amount to about 5000, and the newspapers to nearly 1200; the number of the periodicals and serial works is also large.

Workmen are now occupied in fitting iron doors to the English picture and retrospective galleries; when this is done, which will be in a day or two, the works of art may be at once arranged, and the chance of accident will be reduced to a minimum.

The English carriages make a good show, though unfortunately placed in the machinery gallery, while those of France have a separate department. There are 24 exhibitors, who show nearly 40 carriages of various kinds, from a dog-cart to a dress landau.

The Trinity Board has a fine exhibition. Besides the magneto-electric lighthouse, and two steam fog-horns, which will be found in the garden, there are, in the machinery department, a first-class fixed catadioptric Fresnel lens, with shadowless lantern; a first-class revolving lens, with improved clock-work, the glass work by Chance, of Birmingham; one fixed, and one revolving floating light; a large number of models, including Stevenson's holophotal reflector, composed entirely of glass arranged at the angles of total reflection, and a complete system of lenses, lanterns, buoys, beacons, and accessory apparatus and fittings, the whole making a most interesting exhibition.

India and the colonies promise well; the show of the former is only limited by the area allotted to it, as the objects at the disposal of Dr. Forbes Watson may be said to be unlimited in number, and unrivalled by anything in the Exhibition for beauty of colour and workmanship.

The Canadian court will present a peculiar appearance; the columns of the building have been encased in woodwork, which will be made to represent trunks of trees; a transparent false ceiling will embrace the upper part of these trees, the whole being arranged, with the aid of the decorator, to represent a tent or pavilion in the forest. Within this enclosure will be a fine collection of the timber, ores, and other products of the country, including a gigantic squared yellow pine, 50 feet long, and containing 200 cubic feet of timber. Canada is one of the few colonies that will show machinery, several printing presses and other examples having been sent over. There will also be several specimens of carriage-building, including a trotting carriage of excessive lightness, called *la planche* by the French, and the "spring-board" by English Canadians; two sledges, and a railway sleeping carriage, on the American system.

The fittings and decorations of all the foreign courts are nearly completed, and, in many cases, important contributions are brought to light. One of the most conspicuous and most beautiful is a mosaic picture, of large size, in the Russian court, the design, a group of the saints of the Russian calendar, is by Professor Neff, of the Academy of the Beaux Arts of St. Petersburg; the mosaics are in enamel, and the effect of the work is extremely fine.

The Italian courts are being rapidly completed, and in that of the Papal States a magnetic meteorograph occupies a central position; this is the invention of the Reverend Father Secchi, Director of the Roman Astronomical Department.

The States of Northern, Central, and Southern America are setting out their goods; and the decorators are now finishing off the Chinese and Japanese courts in gold and vermilion, and all the brightest possible hues, the whole being in the style of the countries whose productions are to be exhibited there.

Amongst the new buildings in the Park, the Chinese has become conspicuous by its high square roof, with up-turned corners; the Pavilion of Morocco approaches completion, and has a very marked and peculiar character; while near it rises a large pyramidal building in two stages, which will contain a collection of the antiquities and products of Central America; the fine group of Egyptian buildings is now finished externally, and nearly so inside also, and they are not only striking but remarkable for their solidity and elegance; at another corner of the park a collection of Austrian buildings has sprung up with wonderful celerity. All the out-of-doors work is, in fact, as forward as the weather would permit, and the few days which intervene between this and the opening of the exhibition will doubtless produce immense changes.

The arrangements of the gallery to receive the illustrations of the History of Labour, are nearly all completed, and the contributions are arriving. The Bishop of Saint Brieuc has collected a number of the most precious objects belonging to the churches of his diocese. The authorities and amateurs of Toulouse send a large and rich collection of antiquities, of the Gallo-Roman period. Rheims sends the precious relics belonging to her cathedral; and there are many fine specimens of ancient tapestry and objects of art contributed by the museum and public library of the old city, and by private persons. The Bishop of Clermont has collected the most beautiful specimens of ecclesiastical plate and ornaments in the Puy de Dôme; and the Bishop of Limoges, the Archbishops of Sens, Arras, and Bourges, have collected similar specimens of art manufacture in their several dioceses. The local committees of the departments of the Rhône, the Nord, and the Seine Inférieure have made magnificent collections from the treasures of the churches, museums, and private collections of their districts. Amongst the most remarkable objects in the French section of this department of the exhibition will be the shrine of Saint Chauvin, considered to be the most important specimen of French goldsmith work of the latter part of the thirteenth century. The representatives of the commission at Nimes and Poitiers are said to have made a rich and rare collection. Large contributions are arriving from abroad, but it is much to be regretted, if the report be true, that Belgium and Prussia will not send anything to this section of the exhibition.

The Salle de Conférences, or lecture room, spoken of long since, is now in hand and will soon be finished.

Ten thousand French workmen and workwomen have met and elected the delegates to represent them at the exhibition; the number of representatives thus appointed

is 305 men and 10 women. Each trade or batch of trades had to elect a number of delegates in proportion to its numerical strength, thus the *ouvriers* of the coach, wheelwright, harness-making, and other allied trades named twelve representatives; the bronze founders and workers, and the cabinet makers and other workers in wood, each eight; the letter-press printers, typefounders, and stereotypers, six; the jewellers and goldsmiths, the engineers and mechanicians, the founders, turners and metal workers, the tool and nail makers, and the tanners and leather dressers, each five delegates, and the other groups numbers diminishing down to one. The ten female delegates represent the seamstresses, the stay-makers, artificial florists, the workpeople of the linen warehouses, and the dressmakers, each electing two delegates.

The Exhibition will, like its predecessors, give rise to a considerable number of publications, besides the official catalogues and handbooks. The most important yet announced is entitled "Etudes sur l'Exposition de 1867," by M. E. Lacroix, editor of the *Annales du Génie Civil*. The plan of this work is very elaborate, embracing all the subjects connected with civil engineering, construction, and scientific manufactures, and the list of contributors includes a large number of scientific writers of high standing.

M. Ch. Kerdoël, editor of the *Moniteur Vinicole*, and a practical farmer, announces a special publication on the agriculture of the Exhibition. Both these works are to be published in parts, and are announced to appear in the month of April.

The post office, telegraph office, and a number of restaurants, cafés, and other establishments for the accommodation of the public are now open, and many more will be so in a day or two. The weather is improving, and the prospects of the Exhibition improving with it.

Fine Arts.

RAPHAEL DRAWINGS, &c.—A series of photographs, perhaps unexampled for completeness, from the most celebrated collections, public and private, may now be consulted by students in the National Art Library, Kensington. The series comprises photographs from 90 drawings in Venice, 80 in Vienna, 54 in Windsor, 188 in Oxford, &c., &c. In fact, authentic copies of at least 600 examples of Raphael's scattered studies in ink, chalk, silver-point, and sepia, are now for the first time brought together for examination and collation. The Department of Science and Art, it is known, have for a considerable period entertained the idea of making a grand exhibition of the works of Raphael. This assemblage of photographs may do something to advance the project. The cartoons are already on the spot. "The Raphael Room" which has for some months been open, though as yet more tentative than complete, serves to indicate the mode in which the works and genius of Raphael will admit of illustration. It was a favourite idea of the late Prince Consort, that the three great Italian masters, Leonardo da Vinci, Michael Angelo, and Raphael, should receive systematic and adequate exposition. What progress had been made towards the realization of this intention at the time of Prince Albert's death, may be judged from the photographs, engravings, &c., after Raphael, which fill nearly fifty volumes now in the Queen's library, Windsor Castle; and it was by the authority and under the influence of the Prince Consort, that a large number of the photographs now seen in duplicate at Kensington, were originally executed. There was scarcely a collection, save that in the Biblioteca, Milan, not included in the series. This important collection is still unrepresented at Kensington. A trustworthy photograph from Raphael's cartoon of the "School of Athens" in Milan, would indeed be of great value.

COLLECTION OF ART FAC-SIMILES.—The Belgian Government has decided on adding to its Museum of Antiquities a collection of fac-similes and tracings of ancient mural painting and the most interesting stained glass in the country. As a nucleus for this new museum of art, the authorities have purchased of M. Capronnier, of Brussels, a series of 87 cartoons of the most celebrated painted windows of the churches of St. Gudule, at Brussels; St. Jaques, St. Martin, and St. Scroais, at Liège; St. Wandra, at Mons; St. Pierre, at Louvain; and of the cathedrals of Tournay and Antwerp.

ARCHITECTURAL CONFERENCE.—The Society of the Architects of France invite their *confrères* of all the world to an international conference, to be held in the month of July next, with the object of taking into consideration the methods in use in architectural education, and all questions connected with the subject, and especially to inquire into the tendency of the modern architecture of all nations.

DISCOVERY OF A PICTURE BY VANDYCK.—A St. Cecilia. by Vandyck, said to be one of the finest productions of the artist, and in admirable condition, has been discovered in an extraordinary manner at the village church of Caelevoet, between Uccle and Beersel, in Belgium. Repairs having been necessary, the walls of the little church were stripped, when the picture was found between two boardings.

Manufactures.

TUSCAN COTTON MANUFACTURES.—The manufacture of woven cottons for the dress of the lower classes in Tuscany causes a considerable importation of cotton thread, of which the English manufacturers have the exclusive monopoly. These fabrics, which bear in the country the name of *bordato* and *fustagno*, are made up in nearly all parts of Tuscany, but more especially in the lower valley of the Arno, at Pisa, Pondera, Navacchio, Empoli, &c. At these towns there are more than 100 hand-looms; at present none are driven by steam power. A great number besides are scattered through the country, especially where the straw hat industry fails. Women find in this employment, which allows them to attend to the cares of their household, a useful resource for their families. According to the last statistics published by the grand ducal government, the only one which makes mention of this industry, the number of existing looms in 1856 is estimated at 150,000. Since then they have increased to a considerable degree; their number may now be computed at from 175 to 180,000. The cotton employed in this industry comes, as cotton thread, direct from Manchester and Liverpool to Leghorn, where it is bought by the principal manufacturers, who have it dyed, and distribute it to the weavers, who again distribute it to those who, having no loom, are employed in winding the thread and preparing it for weaving. The work is paid by the piece, at from 7 to 9 centimes the Tuscan ell (1¾ of this measure, is equal to a metre). The weaver can earn from 42 to 56 centimes per day. The winders are also paid by the piece, and cannot earn, working from morning to night, more than 35 to 42 centimes per day. Fabrics of this kind are sold in all the markets and fairs of Tuscany, and the price varies, according to quality, from 84 centimes the Tuscan ell to 1 franc 20 cents. All colours are employed for the fabrics intended for women's dress, deeper colours being used for men's wear—grey, deep blue, or the natural colour of the cotton. The annual manufacture is valued at more than twenty million francs, and the importation of cotton at more than eight million francs. There are at this present time, in the warehouses of Leghorn, nearly four million francs' worth of cotton thread intended for this industry, imported entirely from England. Since the slight rise in cottons, which took place recently, the weavers have abstained from making pur-

chases, in the hope of a speedy fall in price. Nevertheless, the looms are not idle at the present time, owing to the foresight of manufacturers, who, fearing competition with the factories of Northern Italy, and particularly with those mills which have just been erected in Bologna, have kept a great quantity of cotton thread in reserve. One manufacturer, M. Manetti, a very rich proprietor in the province of Pisa, employs at his factory more than 6,000 persons of both sexes—dyers, winders, and weavers.

Commerce.

ARTIFICIALLY COLOURED TEA.—It appears, by the *Produce Markets Review*, that a complete revolution has taken place in the distribution of the Japanese crop, for whereas a few years ago the greater part went to England and China, and little more than one-fifth to the United States, the latter now monopolize nearly the whole supply. The explanation of the diminution of shipments to England is probably that the public here will not buy natural green teas, but prefer them artificially coloured with Prussian blue and gypsum. During the American war, the taste of the English public was met by sending the pure Japanese tea to China to be dyed green; but the Americans, who drink a great deal of Oolong, show great partiality for the fine-flavoured Japan teas. That Japan tea was ever sent in any considerable quantity to China, suggests the old proverb about sending coals to Newcastle. It may, as we have said, have been sent there to be coloured, but we should have thought that the Japanese, who at least equal if they do not excel the Chinese in manual dexterity, could have performed this process at home. They may do so now, for all we know: but it would be more pleasant to suppose that the Americans drink the tea in its uncoloured state.

Colonies.

BANKING IN MELBOURNE.—In the year 1856 the eight banks then existing held, on an average, coin to the amount of £2,798,257, and had notes in circulation to the extent of £,2,328,226; but, notwithstanding the increase of trade, and the development of resources then unknown, the note circulation and the stock of coin has gradually declined. The value of coin held on the 30th June, 1866, was £1,259,767, and their notes in circulation but £1,278,030, showing a decrease in the last ten years of £1,538,490 in the bank stock of coin, and of notes in circulation £1,050,236; but during this period the deposits have continued to increase. In 1856 the average amount of deposits held was £5,967,330, and in the quarter ending June, 1866, they were £8,799,962. This reduction has been going on with increased profits and capital, showing that there is no insolvency in the matter. The long drought has, doubtless, contributed to the present scarcity of money. The precise amount of loss caused by the drought is unknown, but it is estimated at about £700,000.

Notes.

EDUCATION AND CRIME.—Lord Chief Justice Bovill, in his charge to the grand jury at the assizes at Lewes—alluding to the remarkable distinction between the calendar for the eastern and western divisions of the county, in this respect, that few of the prisoners in the former could read and write, whereas most of those in the latter could, and that there was much less crime in the latter than the former—observed upon the great importance of education as a means of preventing crime. He remarked upon the terrible temptations to crime which were presented by idleness to ignorance. Persons unable to read, and thus shut out from a whole world of innocent entertainment, when they found themselves idle and unemployed, what were they to do? It was obvious that such persons were exposed to peculiar temptations to crime, simply for the reason that they did not know what to do with themselves when unemployed. This was peculiarly the case in agricultural districts, and it strongly showed the extreme importance of educating the children of the poor, especially of the agricultural population. He was aware of the temptation which there was to keep children from school when they were able to earn money, but this only showed the importance on the one hand of getting them to school as early as possible, and, on the other hand, of persuading them to attend evening schools, at all events on some days in the week.

Correspondence.

THE FOOD COMMITTEE.—SIR,—I have read with great interest the papers on Food published in your journal on the 8th and 15th of March; but with reference to the extract of meat, I cannot understand how Dr. Thudichum arrives at his conclusions marked *a*, *b*, *c*. These conclusions seem to me singularly at variance with the facts of the case. 1st. As to "convenience" of use. The "extract of meat" is sold in 2 oz. pots, which may remain open, without the slightest protection, for days, and yet no change or decomposition takes place. As to loss by "sub-division," there is none whatever; the extract certainly sticks to the spoon, like treacle, but of course is all dissolved and taken up by the water used. 2nd. As to the supposed "necessity of storing in a cool larder." The sample of extract sent by me to the Committee on Food was made in New South Wales, in Nov., 1866, when the thermometer averaged 85° in the shade. It came home in the hold of a P. and O. steamer, through the Red Sea, the heat in the hold averaging over 90°.—Liebig states (Annals of Chemistry, vol. 133, p. 125, year 1865): "I have now before me samples which have been preserved 15 years in vessels stopped with a simple cork or paper, and which exhibit no sign of deterioration." So much for the necessity of a cool larder. 3rd. As to the "intelligence" required in using the extract of meat. About the same degree of intelligence is required as in making tea, perhaps hardly so much, as it is not absolutely essential that the water used should be actually boiling. The following is from a Report by Dr. Parkes, Professor of Hygiene, Army Medical School, and published by the authority of Government:—"In all our trials even small quantities produced a feeling of support and vigour which ensued very soon after it was taken. For the military surgeon it is likely to be very useful in active service, not only for the sick and wounded, but for healthy men. Its small bulk, *ease of cooking*, savoury taste, and great restorative action, would make it most useful in rapid expeditions." I may add that in Mr. Chester's remarks, published in last week's *Journal* (p. 274), he speaks of the preserved boiled beef as "Tindal's;" it should be described as produced by the "Australian Meat Company (Limited)."—I am, &c., C. G. TINDAL.

MEETINGS FOR THE ENSUING WEEK.

MON..... R. United Service Inst., 8½. Prof. W. J. Macquorn Rankine, "The Economy of Fuel, comprising Mineral Oils."
Society of Arts, 8. Cantor Lecture. Mr. John Hullah, "On Music and Musical Instruments."
Farmers' Club, 5½. Discussion on "The Desirability of a Board of Agriculture as a Government Department." Introduced by Mr. Nockolds.
Odontological, 8.
London Inst., 7. Prof. Westwood, "On Entomology."
Society of Engineers, 7½. Mr. Henry Davey, "On Pumping Engines for Town Water Supply."
Royal Inst., 2. General Monthly Meeting.
Entomological, 7.

Medical, 8.
Asiatic, 3.
Victoria Inst., 8.
TUES ...Horticultural, 3. Fruit and Floral and General Meeting.
Royal Inst., 3. Rev. G. Henslow, "On the Practical Study of Botany."
Civil Engineers, 8. Mr. W. A. Brooks, "Memoir on the River Tyne."
Pathological, 8.
Anthropological, 8.
Geologists' Assoc., 8.
WED ...Society of Arts, 8. Discussion, "How to provide Healthy and Cheap Dwellings for the Working Classes with Financial Success." Introduced by Mr. Thos. Hawksley.
Geological, 8. 1. Mr. W. Boyd Dawkins, "On the Dentition of *Rhinoceros leptorhinus*." 2. Rev. P. B. Brodie, "On the Drift of part of Warwickshire." 3. Mr. J. W. Judd, "On the Strata which form the base of the Lincolnshire Wolds."
Pharmaceutical, 8.
Obstetrical, 8.
THUR ...London Inst., 7. Prof. Bentley, "On Botany."
Royal Inst., 3. Mr. W. Pengelly, "On the Geological Evidences in Devonshire of the Antiquity of Man."
Linnæan, 8. Mr. J. G. Baker, "On the Geographical Distribution of Ferns."
Chemical, 8.
Royal Society Club, 6.
Artists and Amateurs, 8.
Royal, 8½.
Antiquaries, 8½.
FRI .....Philological, 8.
Royal Inst., 8. Mr. W. Pengelly, "On the Insulation of St. Michael's Mount, Cornwall."
Archæological Inst., 4.
SAT .....R. Botanic, 3½.
Royal Inst., 3. Mr. W. Pengelly, "On the Antiquity of Man."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 21st March, 1867.

Par. Numb.
68. Bills—Uniformity Act Amendment.
71. ,, Oxford and Cambridge Universities Education.
73. ,, Grand Jury (Ireland) Amendment.
129. Army (Artillery and Engineers)—Correspondence.
137. (1 to 13) Railway, &c., Bills (Parts 1 to 13)—Board of Trade Reports.

SESSION 1866.

251. (II.) East India (Military Finance)—Annual Statement.

Patents.

From Commissioners of Patents' Journal, March 22nd.

GRANTS OF PROVISIONAL PROTECTION.

Animal size, packing, &c.—607—J. C. Martin.
Baling bands, couplings for—630—A. V. Newton.
Belts, fastenings for—530—A. V. Newton.
Bituminous substances, distilling—650—W. Young and P. Brash.
Boilers—609—T. Beeley.
Bottles, &c., cases for—615—G. Withy and J. F. Cotterell.
Brackets, adjustable—618—E. Wells and W. Pryor.
Breech-loading fire-arms and cartridges—447—H. Haschke.
Breech-loading fire-arms, cartridges for—660—G. H. Daw.
Bridle bits—638—H. W. Achgelis.
Burners, regulating the supply of gas to—577—W. C. Thurgar.
Calico printing machines—628—W. Tomlinson.
Carriages—622—G. H. Morgan.
Casks, bushings for bung holes of—648—W. Hurrell.
Chains, &c.—528—J. G. Taylor.
Clockwork, winding up—532—C. E. Brooman.
Compasses, protecting the needles of—676—J. S. Gisborne.
Drying cylinders, regulating the speed of—674—A. Rupp.
Eggs, hatching—640—S. Wortley.
Fabrics, producing boarders on—585—S. Frank and R. Gooddy.
Fagots—540—T. Humphreys.
Fan blowers, actuating—646—W. Clark.
Fibrous substances, preparing—666—J. Horton, jun.
Fibrous substances, preparing, &c.—589—A. and H. Illingworth.
Fire-arms, breech-loading—594——W. R. Pape.
Fire-arms, breech-loading—599—M. A. F. Mennons.
Fire-arms, repeating breech-loading—619—G. Haseltine.
Flax stripping machines—596—W. E. Gedge.
Fluids, &c, raising, &c.—686—W. B. Nation.
Gas—624—J. Thompson.
Glove fastenings—656—J. H. Johnson.
Hook, a compound safety disengaging—573—J. C. Broadbent.
Hydro-carbon oils—611—A. S. Macrae.
Hydro-carbons, treating—563—A. A. Croll.
Inkstands—557—J. Piddington.
Insects, destroying—605—S. Newington.
Iron bands, fastening—595—T. J. Binfield.
Knobs, securing—553—T. Hyatt.
Lace—544—S. Butler.
Lamps—678—G. Glover.
Lamps, miners' safety—617—G. Rowley.
Light, artificial—556—A. G. Chalus.
Liquids, cooling and freezing—625—H. C. Ash.
Liquids, transporting, &c.—583—M. Gossi.
Locomotives, &c., indicating the speed of—581—F. W. Jones.
Locks—654—F. Pope.
Locks, &c., knobs for—664—S. Hawthorn.
Materials, conveying, &c.—620—J. R. Breckon and R. Dixon.
Metallic ores, reducing, &c.—652—S. C. Salisbury.
Mines, destroying explosive gases in—565—J. Harbert & F. Goodman.
Motive power—278—I. Baggs.
Motive-power engines—558—A. McCallum.
Mouldings, cutting, &c.—604—R. Thompson.
Needle cases—603—J. W. Lewis and G. Archbold.
Oils, utilizing—616—J. E. Duyck.
Optical illusions, producing—629—H. W. Haliett.
Ovens—562—J. Buhrer.
Porcelain—642—W. E. Newton.
Railroad carriages, starting—670—W. Clark.
Railway axles, bearings for—672—L. Tidén.
Railway signals, &c.—538—J. Saxby and J. S. Farmer.
Reel frame and thread cutters, combined—598—R. E. Keen.
Safety gauges, self-acting—591—J. A. Coffey.
Screws and bolts—550—A. V. Newton.
Sewage, treating—579—W. Parry and J. Frearson.
Sewing machines—561—E. T. Hughes.
Sewing machines—636—I. Dimock and J. Gresham.
Shirts, &c., metallic fronts for—606—J. M. Stanley.
Steam and gas engines—571—A. V. Newton.
Steam boiler furnaces—634—W. Heginbottom.
Steam boilers—626—E. Storey.
Steam boilers—662—J. Whitaker.
Steam driving wheels—536—W. Stobbs.
Steam engines and pumps—621—J. G. Tongue.
Steam, generating, &c.—601—J. Marchent and J. Parker.
Steam hammers—644—W. E. Newton.
Steering apparatus—559—A. B. Brown.
Stones, &c., crushing—680—B. Walker and J. F. A. Pflaum.
Telegraph wires, insulators for—632—G. Davies.
Tent poles—600—E. Deane.
Textile fabrics—548—M. Mackay.
Tobacco pouches—65—G. Inderwick.
Towels—513—J. and J. Cash, jun.
Truss supports—569—W. E. Newton.
Tunnels, perforating—575—T. Berrens.
Umbrellas, &c.—602—R. E. Waddington.
Vehicles, apparatus for receiving money in—554—R. E. Guy.
Wearing apparel—610—F. H. Jones.
Wheels—567—G. F. Russell.
Wheels, tyres for—668—J. Newman.
Yarn and thread, winding—682—H. C. Hill.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Fire-arms, breech-loading—798—E. L. Sturtevant.
Safety valves—794—A. S. Cameron.
Steam boilers—783—J. Robinson.
Steam engines, slide valves of—718—J. Thévenet.

PATENTS SEALED.

2452. J. Calvert.
2453. R. Kunstmann.
2454. J. and A. Gamgee.
2459. W. Hunter.
2461. C. E. Brooman.
2463. J. Barker.
2470. G. E. van Derburgh.
2474. T. B. Taylor.
2478. T. Amey.
2479. J. C. Sellars.
2540. W. Hope and H. Browning.
2930. H. A. Bonneville.
3116. A. Fournet and O. Nadaud.
3208. R. Carte.
3243. W. Richards.
3255. W. Hopkinson.
260. W. R. Landfear.

From Commissioners of Patents' Journal, March 26th.

PATENTS SEALED.

2492. W. R. Corson.
2498. J. E. Thibault.
2500. G. Slater.
2504. F. W. C. Dromtra.
2506. J. and J. Broughton.
2511. S. Price.
2516. D. Imhof.
2520. W. la Penotière.
2521. W. Clark.
2524. J. Chalmers.
2534. D. Barker.
2557. G. E. Donisthorpe.
2559. J. H. Johnson.
2586. J. Robertson.
2991. H. Lampson.
76. J. Howard & E. T. Bousfield.
102. H. A. Bonneville.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

711. J. Reilly.
807. E. Stott.
725. W. Howe.
726. D. H. Barber.
718. J. Bennie, jun.
719. J. and J. Lawson, jun.
721. J. Leslie.
959. W. Clark.
971. W. E. Gedge.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

723. J. Aspell, E. Booth, & J. Hurst.
734. W. Spence.
810. I. Holden.
755. C. Ashworth.